

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings of claims in the application:

LISTING OF CLAIMS:

1-6. (Canceled)

7. (New) A steam-liquid heat exchanger for the treatment of stillage generated by distillation in the tequila industry, steam-liquid heat exchanger comprising:

a steel duct;

a steam inlet for injection of clean steam, said steam inlet being on the top left outside of said steel duct,

an air bleed for draining said apparatus, said air bleed being on the bottom right of said steel duct,

a plurality of steel pipes through which the stillage circulates when inside said steam-liquid heat exchanger, said steel pipes being inside said steel duct and supported by risers with separating partitions to stop the steel pipes from bending,

a cleaning valve, which is a steel flange for eliminating fouling incrustations inside the steel pipes when the steam-liquid heat exchanger is in operation, said cleaning valve being connected to the outside top of said steel duct and is adapted to be connected and disconnected for cleaning; and

a stillage feed head that is a T-shaped steel flange through which the stillage is injected into the exchanger, wherein said stillage feed head is removable and is connected to the bottom outside of said steel duct.

**8. (New)** A stillage evaporator for the treatment of stillage generated by distillation in the tequila industry, said stillage evaporator comprising:

an elbow at the top of said stillage evaporator for connecting to a cyclone,

a vapor lock lid connected to said elbow, said vapor lock lid adapted to avoid internal pressure and accumulation of solid material on the walls of the stillage evaporator, and having an inlet on top on the right side to enable cleaning, and on the left side, a safety valve to release pressure during an evaporation operation,

a first cylinder connected to said vapor lock lid, having a duct or a tangential inlet inside through which steam passes, wherein said duct is connected to a shock partition,

a second cylinder that is a conical connection cylinder and is connected to said first cylinder, and is adapted to reduce the area of contact in the lower part of the apparatus,,

a T-shaped pickup pipe that is connected to said conical connection cylinder and which is a steel flange that connects the stillage evaporator with a steam-liquid heat exchanger, by sealing

a stillage feed head of the steam-liquid heat exchanger, wherein the pickup pipe is a container for receiving concentrates that drain out.

9. (New) The apparatus of claim 7, wherein the plurality of steel pipes consists of 130 steel pipes.

10. (New) The apparatus of claim 8, wherein said first cylinder contains a steel filter that when packed forms a bed for attenuating internal pressure resulting from fouling by scattered material therein, and is adapted so that when steam passes through the filter all the solids are eliminated.

11. (New) The apparatus of claim 8, wherein said shock partition is stainless steel so that steam coming from the duct or the tangential inlet is absorbed by the partition, thereby producing the effect of increasing the steam velocity to 149.98 m<sup>3</sup>/min.

12. (New) A method for the treatment of stillage generated by distillation in the tequila industry, said method comprising the steps:

(1) receiving and discharging into a first storage tank a residual stillage generated by distillation and mashing in the preparation of alcoholic beverage tequila, said stillage having a

temperature in the range of 80 and 85°C, wherein said first storage tank is connected to a recirculation pump to keep the stillage mixing inside the first storage tank until the stillage solids are in a homogenous state, said recirculation pump being connected to a solids decanter;

(2) separating solids from the liquid in the stillage by use of centrifugal force generated in said solids decantor under operating conditions, including rpms of 2300/minute, resulting in a 1°C decrease in the temperature, causing the solids to separate from the liquid, to produce a liquid stillage having a low concentration of solids, and collecting and transferring said liquid stillage to a second storage tank having steam coils and maintaining the liquid stillage under optimum temperature conditions,

(3) when an operating level of 15,000 liters of liquid stillage is obtained, transferring the liquid stillage by way of a stillage transfer pump to the steam-liquid heat exchanger of claim 7, wherein clean steam coming from boilers is injected and controlled by a disk valve at a pressure of 3 kg/cm;

(4) transferring the steam obtained from step (3) to the stillage evaporator of claim 8 by injection means of the duct with tangential inlet, which upon hitting the partition produces a tangential effect therein and due to the speed of evaporation of the liquid stillage, the steam reaches an operating pressure of 3 kg/cm<sup>2</sup>, and a velocity at which impact against the partition

generates spiral turbulence, the intensity of which increases the weight of particles in the steam, thereby causing them to sediment, and to obtain purified steam with the quality of water vapor; and

(5) optionally transferring the steam obtained in said stillage evaporator in step (5) to a cyclone a for a second purification treatment process which will yield steam with the quality of water vapor.

13. **(new)** The method of claim 12, wherein in step (1) the physical and chemical characteristics of said stillage is retained and comprises a temperature 84°C, a pH 3.2, biochemical oxygen demand 15,200 mg/liter, total solids 17,368 mg/liter, and soluble biochemical oxygen demand 21,100 mg/liter.

14. **(new)** The method of claim 12, wherein the time the stillage remains in the first storage tank is between 10 minutes and 25 minutes and will depend on the load of stillage which is produced in the distillers and mashers.

15. **(new)** The method of claim 12, wherein in step (1), the speed at which the homogenous state is obtained will depend on the type of recirculation pump used for the type of discharge.

16. (new) The method of claim 15, wherein for a load of 0.11 m<sup>3</sup>/hrs - 110 liters/hour a vertical type centrifugal pump 6000-8000 mg/liters will be needed.

17. (new) The method of claim 12, wherein the time between which the stillage enters the solids decanter until separation is about 2 seconds.

18. (new) The method of claim 12, wherein in step (1), the solids move into one of the ends of the solids decanter and the liquid is collected or carried by a collecting channel.

19. (new) The method of claim 12, wherein the solids from step (2) are converted to a semi-dry paste with a relative moisture content of 18%.

20. (new) The method of claim 12, wherein the liquid stillage having a low concentration of solids obtained in step (2) has a final solids concentration of less than 8 ppm mg/liter.

21. (new) The method of claim 12, wherein the second 2<sup>nd</sup> stillage storage tank has a 22,000-liter capacity.

22. (New) The method of claim 12, wherein when the stillage transfer pump transfers the liquid stillage having the

low concentration of solids, said liquid stillage has a temperature of 83°C.

23. (New) The method of claim 12, wherein the evaporation time in step (4) is from 2 to 3 seconds.

24. (New) The method of claim 12, wherein the time for steam to be generated in the stillage evaporator is from 5 to 10 and attains a temperature of 110° to 130°C, and wherein fine solids obtained in the steam generation stage are deposited in the bottom of the stillage evaporator and are mixed into the fatty solids obtained in the solids decanter.

25. (New) The method of claim 12, wherein the purified steam obtained from the stillage evaporator in step (4) is sent through the elbow in the stillage evaporator to the cyclone for the second purification treatment.

26. (New) The method of claim 12, the cyclone produces the same tangential effect achieved in the stillage evaporator, since the steam enters the cyclone at a pressure of 3 kg/cm<sup>2</sup> the impact of which within the cyclone generates turbulence and causes fine residual particles in the steam to deposit and to obtain purified steam with the quality of water vapor.

27. (New) The method of claim 12, wherein the steam generated in step (4) or (5) is maintained in a range of 130-140°C, thereby ensuring that traces of alcohol are eliminated through an air venting line and that the steam does not contain volatile elements.

28. (New) The method of claim 27, wherein the steam has the quality of 100% water vapor and is injected into a steam head at a pressure of 3 km/cm<sup>2</sup> into a steam line and is sent on to the mashers, rectifying stills or cooking ovens.

29. (New) An apparatus for the treatment of stillage generated by distillation in the tequila industry, said apparatus comprising:

(1) a steam-liquid heat exchanger comprising:

(i) a steel duct;

(ii) a steam inlet for injection of clean steam, said steam inlet being on the top left outside of said steel duct;

(iii) an air bleed for draining said apparatus, said air bleed being on the bottom right of said steel duct;

(iv) a plurality of steel pipes through which the stillage circulates when inside said steam-liquid heat exchanger, said steel pipes being inside said steel duct and supported by risers with separating partitions to stop the steel pipes from bending;



(v) a cleaning valve, which is a steel flange for eliminating fouling incrustations inside the steel pipes when the steam-liquid heat exchanger is in operation, said cleaning valve being connected to the outside top of said steel duct and is adapted to be connected and disconnected for cleaning; and

(vi) a stillage feed head that is a T-shaped steel flange through which the stillage is injected into the steam-liquid heat exchanger, wherein said stillage feed head is removable and is connected to the bottom outside of said steel duct; and

(2) a stillage evaporator comprising:

(i) an elbow at the top of said stillage evaporator for connecting to a cyclone;

(ii) a vapor lock lid connected to said elbow, said vapor lock lid adapted to avoid internal pressure and accumulation of solid material on the walls of the stillage evaporator, and having an inlet on top on the right side to enable cleaning, and on the left side, a safety valve to release pressure during an evaporation operation;

(iii) a first cylinder connected to said vapor lock lid, having a duct or a tangential inlet inside through which steam passes that was generated in the liquid-heat exchanger, wherein said duct is connected to a shock partition;

(iv) a second cylinder that is a conical connection cylinder and is connected to said first cylinder and adapted to reduce the area of contact in the lower part of the apparatus; and

(v) a T-shaped pickup pipe that is connected to said conical connection cylinder and which is a steel flange that connects the stillage evaporator with the liquid-heat exchanger, by sealing the stillage feed head of the liquid-heat exchanger, wherein the pickup pipe is a container for receiving concentrates that drain out.